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EMERGENCY WIND-EROSION CONTROL

By Glenn K. Rule, *Soil Conservation Service, in collaboration with subject-matter specialists*

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FOREWORD

During the last 5 years soil drifting and dust storms have occurred in the Great Plains more frequently and with greater severity than at any time since occupation by farmers. In 1936 extended areas within the borders of the region entered the winter in a vulnerable condition. Because of the drought, the soil was almost bare of vegetation and nearly devoid of binding roots. It is now in poor condition to resist the high winds of spring.

RAINFALL SHORTAGE

The rainfall story for 1936, generally speaking, was the same in the Great Plains States as for the 5 preceding years. With a few exceptions, notably Wyoming, Colorado, New Mexico, and Texas, rainfall in the first 10 months of 1936 was much below normal; in North Dakota it was 50 percent of normal; in South Dakota, 52 percent; in Montana, 75 percent; in Nebraska, 61 percent; in Kansas, 69 percent; and in Oklahoma, 70 percent.

The rainfall in South Dakota during these 10 months set a new low record of 9.74 inches, as compared with the normal of 17.01 inches at the Huron Weather Bureau. October was the eighth consecutive month with subnormal rainfall. On December 1, E. P. Rothrock, State geologist, reported, after a survey of lakes in South Dakota, that the ground-water level in that State was the lowest since 1893.

INADEQUATE VEGETATIVE COVER

Crop failures and near failures were common in 1936. As a consequence, there is little cover to protect the cropped land during the approaching spring season. Grass on the range also has had little opportunity to recover and thicken. Crop yields for 1936 indicate

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the scarcity of soil-protecting crop residues over the Plains generally. Over large acreages crops were so poor that no attempt was made to harvest them. Harvested yields were less than half of the average over much of the area extending from eastern Montana and North Dakota south into north-central Texas. The 1936 yield for all crops in North Dakota estimated at 45 percent of the 10-year average; that in South Dakota at 37 percent, Nebraska 45 percent, Kansas 62 percent, Oklahoma 52 percent, Texas 89 percent, Montana 52 percent, Wyoming 77 percent, and Colorado 95 percent.

The principal spring wheat States are in the area most seriously damaged by drought and heat. Loss from this crop was one of the most drastic in history.

The acreage and condition of fall-sown wheat as it entered the winter gives some indication of the ground cover to be afforded during the severe blow months. Plantings of winter wheat increased by 7,479,000 acres in 1936 as compared with plantings the previous year. There was slight decrease in the western group of States, however, the principal decreases in seeding occurring in the northern Great Plains area.

The condition of the winter wheat crop on December 1, 1936, was 61 percent of normal in South Dakota, 58 percent in Nebraska, 80 percent in Kansas, 68 percent in Oklahoma, 72 percent in Texas, 64 percent in Montana, 68 percent in Wyoming, 82 percent in Colorado, and 67 percent in New Mexico.

In his monthly livestock and range report, E. V. Jones, Federal agricultural statistician, Brookings, S. Dak., reported that "practically no winter range pasture remains in the north half of the western range area." He reported range conditions on November 1 as 43 percent of normal as compared with the 10-year average of 78.5 percent.

In general, the situation points to the possibility of soil blowing in 1937 as severe as that in previous years. Some areas are in better condition to resist the normal spring winds than others. In the northern Great Plains, perhaps the worst areas from the standpoint of potential winter and spring blowing, include north-central and central South Dakota, northwestern South Dakota and southwestern North Dakota, south-central North Dakota, and northeastern and eastern Montana. In the southwestern Great Plains the total area without effective cover has been somewhat reduced from that of last year because occasional spots received more moisture. Feed crops which left a protective stubble and the early fall-sown wheat supply effective cover in these local areas. Areas along the eastern and southern borders of the region are slightly less hazardous than they were at this time last year. Uncertain conditions prevail, however, on late-sowed and less moist wheatland.

WHAT MAY BE DONE

Two questions arise: (1) What can be done to provide protection for the soil during the winter and prior to the time when the winds blow in the spring; and (2) what can be done when the blow period has arrived.

The Plains farmer has at least two recourses: (1) He can protect stalk, stubble, and pasture fields from being overgrazed or burned; and (2) he can have his unprotected fields roughened before the soil starts drifting. An ounce of prevention is better than a pound of

FIGURE 1.—If not overgrazed or burned, trash and stubble of crop residues help to hold the soil against the wind.

cure. Fields in the northern areas which freeze deeply are not protected by snow unless there is an adequate vegetative cover. Such fields should be roughened properly before freezing, in order to withstand the drifting which follows winter snows. When the ground thaws in the spring, these fields again will need attention to protect them from wind erosion.

CROP RESIDUES

Stubble or stalks left on the field are a very definite aid in holding the soil against the wind (fig. 1). Above ground the stalks help to break up wind curents and to catch and hold in place soil that has started to move. Underground, the root system ties the soil to the plant and the plant to the soil.

Obviously, if crop residues are disturbed or destroyed by burning or overgrazing the soil has less protection. Some of the worst

examples of wind erosion on the Plains may be traced directly to these two destructive practices. Grazing rights on stalk fields are often sold. The one purchasing the right usually will leave his herd or flock on the field until the last scrap of vegetation has been consumed. Severe trampling of stubble or stalk fields may make an otherwise well-anchored soil susceptible to erosion. Chiseling hoofs tend to pulverize a dry surface, making it ready to move with the first strong wind.

The ideal arrangement, of course, would be to have a reserve feed supply stored and at hand, making it unnecessary to turn animals into stalk fields or stubblefields. If it is absolutely necessary to pasture these fields, it should be done under close supervision. Flocks or herds should be removed before the ground cover is seriously jeopardized.

TYPES OF SOIL LIKELY TO BLOW

Sandy soils are the most difficult to hold against the wind although almost any type of soil will blow if conditions are favorable. Sandy soils usually contain little partly decayed organic matter. Organic matter helps soil particles to cling one to another. Because sandy soils are coarse-grained and are usually lacking in sufficient organic matter to bind the particles together, they are susceptible to blowing. Because of the ease with which sandy soils erode, it is difficult to control the soil drift by cultivation after it is once under way. In general, the more sand the soil contains the greater the likelihood of its blowing.

EROSION STARTS IN SPOTS

Soils usually start drifting in small areas in a field. These areas, often called blow spots, increase in size as the wind continues. Thus, with an increasing area and depth of soil in movement, these blow spots become a menace to adjoining fields that lie in the path of the wind. If they are kept under control, the remainder of the field may need little attention. If they are not controlled, adjoining fields are menaced (fig. 2). The adjoining fields may have enough vegetative cover for their own protection, but drifting soil from the blow spots may start them eroding. When this happens, control ceases to be an individual problem and becomes a matter of public concern.

OBSTRUCTIONS: THE ANSWER

Obstructions of any kind in the path of a moving stream of wind-blown soil will check the driving force of the wind and pile up the soil. On wind-swept fields soil particles lodge behind thistles and other weeds, because they check the velocity of the wind. Woven-wire fences and even barbwire fences will check wind currents, thus causing soil to accumulate. These observations suggest what man

can do to stop soil from drifting. Emergency control of excessive soil-blowing consists essentially in placing obstructions in the path of the wind.

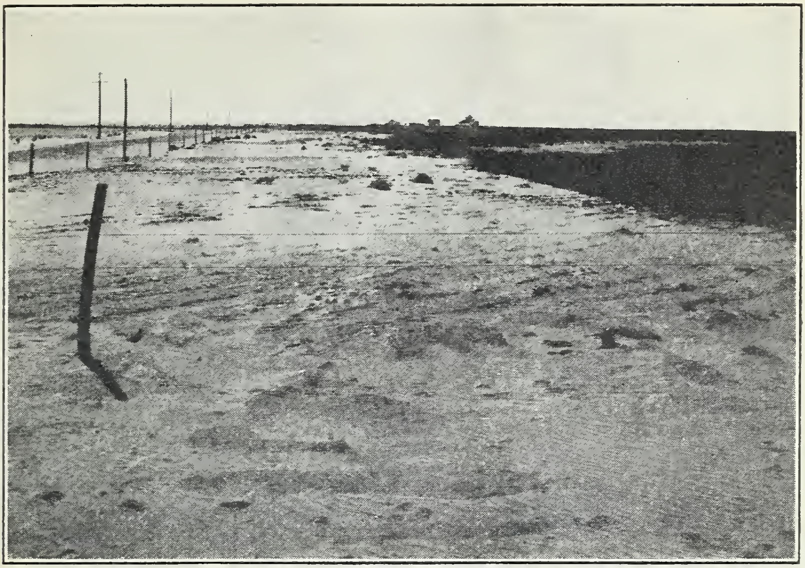

FIGURE 2.—Fields with sufficient vegetative cover for their own protection are often menaced by soil drifting from unprotected areas. Soil is being blown across this South Dakota road from the field on the left.

TOOLS TO USE

On cultivated fields devoid of vegetative cover, protective cultural operations should be completed before the ground is frozen in the fall. The following spring, leveled portions or blow spots should be roughened before the strong winds begin their customary attack. One should never wait until the soil begins to drift before starting action.

Any tillage implement that roughens the surface and leaves it furrowed may be used. More permanent results are obtained if the furrows are deep and if the surface is left in a cloddy condition (figs. 3 and 4).

The lister is the most effective implement to use, because it makes deeper furrows than do other implements, thus providing more room to trap drifting soil (fig. 5). However, the ordinary shovel cultivator is very effective and is cheaper to operate if all the shovels, except the two outside ones, are removed, and those are set straight. This makes furrows about 38 to 42 inches apart, is light of draft, and covers the ground cheaply and rapidly. These furrows, however, have little capacity for storing rain water; yet they aid the cultivation which should follow the rain.

The chisel cultivator is an effective implement to use if the soil is so dry that clods cannot be brought to the surface with a lister (fig. 6). On land too hard and dry to work with a lister some

FIGURE 3.—For quick, temporary results unprotected fields may be strip-listed.

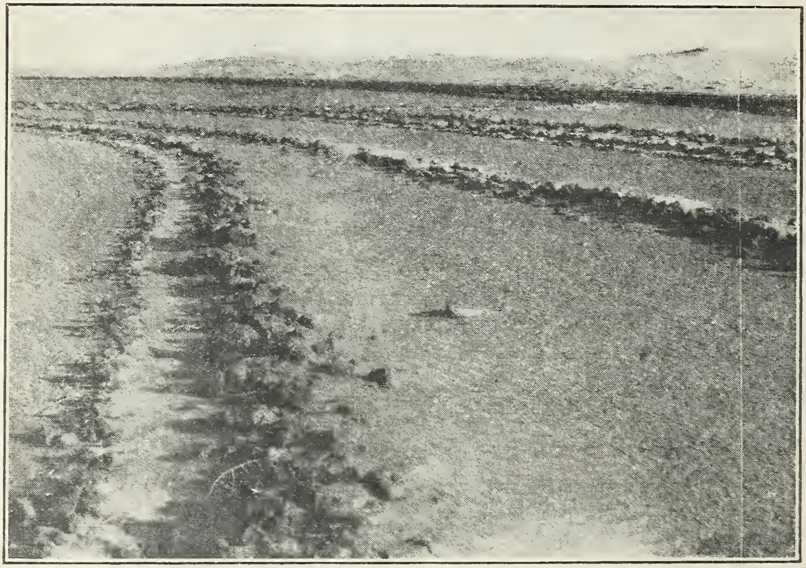

FIGURE 4.—Clods check the driving force of the wind, causing soil particles to accumulate.

farmers have had success in using the "wide-spaced one-way." This implement is an ordinary one-way disk plow with most of the disks removed. Other types of implements at hand may be used, but

the important point to consider is their effectiveness in erecting clod and furrow barriers against the wind so that moving soil may be trapped.

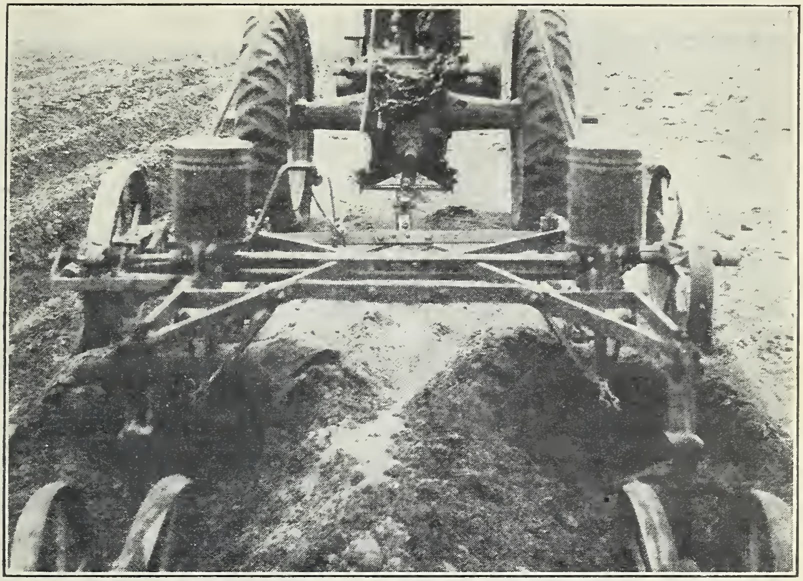

FIGURE 5.—Deep furrows effectively trap moving soil. The lister is a desirable implement to use for this purpose when conditions are favorable.

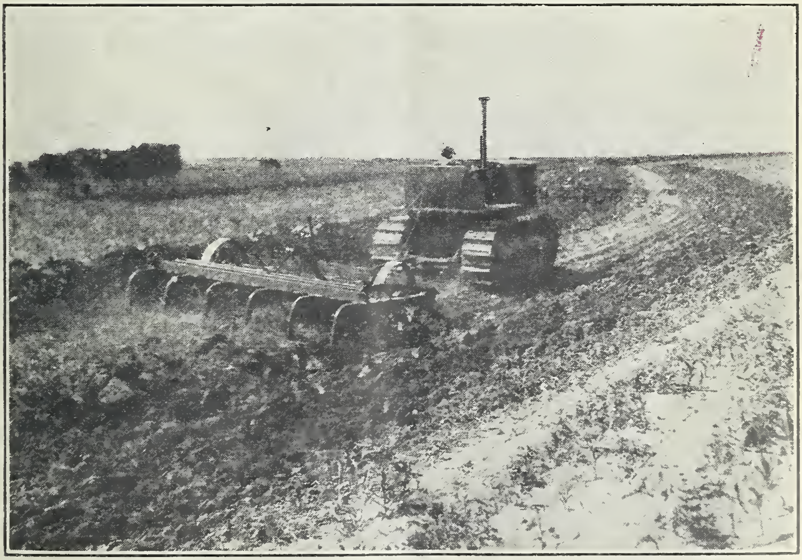

FIGURE 6.—On soil too loose and dry for effective treatment by the lister, the chisel cultivator may be used. This implement is especially effective in raising large clods to the surface.

Listing or other emergency-tillage operations should follow the contour lines of the field wherever possible in order to conserve water as well as to diminish soil drifting. Level or nearly level furrows will hold more water than furrows that run up and down a slope. The additional water will soak into the ground for the benefit of vegetation. If it is impracticable to run the tillage furrows on the contour because the land is excessively hummocky, or for other reasons, the basin lister may be used (fig. 7). This tool is very effective in conserving moisture. Even though the furrows are run only on an approximate contour, each little dam across the furrow channel traps some water. The hole digger (fig. 8) leaves an uneven surface, and each depression holds water after a rain. Strip listing is cheaper and faster in obtaining temporary control but less effective in conserving moisture.

EMERGENCY TILLAGE: A TEMPORARY MEASURE

Emergency tillage to prevent soil drifting must be considered as only a temporary measure. Proper methods of tillage may delay destructive action of the wind for short periods, but cultivation will not stop soil blowing permanently. Tillage must be considered as a method of holding the soil until rain falls. Rain, in turn, will help supply the necessary moisture for vegetation to start, provided such rainfall is retained through proper conservation measures. After a rain the surface of the soil will blow again as soon as it becomes dry, and the moving soil will destroy plants that have started their growth. For this reason it is necessary to roughen the surface after a rain.

FUTURE CONTROL

This discussion points out effective control measures that may be used during an emergency. These measures are expensive to employ and are only stop-gap efforts. The pressing problem for the future is to find ways of minimizing the hazard of having bare land exposed to the wind. The land must be given a more adequate cover of native grass, and cultivated crops better adapted to the Great Plains region must be grown.

WATER IS THE KEY

Water is the key to wind-erosion control on the Great Plains. Soil moisture helps to insure vegetation, and vegetation, in turn, is the only permanent control against wind erosion. Rainfall on the plains is usually limited. The amount of water which falls on the land is not so important as how much of this water is made available for plant growth. By exercising proper conservation methods one

farmer may get as much benefit from a 2-inch rain as another who has not employed conservation measures gets from a 3-inch rain (fig. 9).

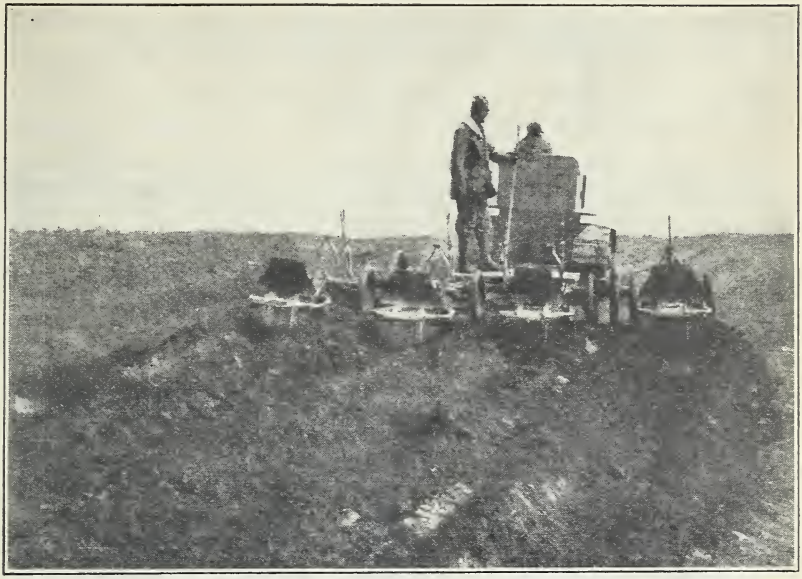

FIGURE 7.—The basin lister provides effective barriers against the wind. But it does more: each little dam in the furrow traps rainfall, permitting it to soak into the soil.

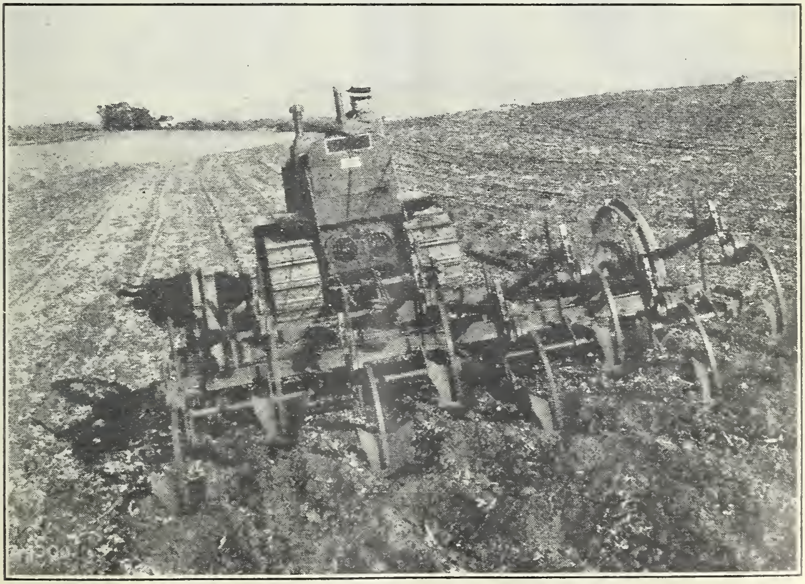

FIGURE 8.—The hole digger is another implement that leaves the soil in a roughened condition. Each hole traps rainfall and keeps the water where it will do the most good.

Through governmental aid more than 2,000,000 acres of land in the southern and central part of the Great Plains were listed on the contour in the spring of 1936. Following late May rains, a large number of moisture-penetration tests were made on contour-tilled land and on land adjacent which was level-tilled or untilled. These tests showed that about 1 inch of additional moisture was retained as a result of this listing on the contour. Because of this extra inch of moisture the soil on contoured areas was wet slightly more than

FIGURE 9.—If fields are listed on the contour there is little opportunity for water to run off. A 2-inch rain fell on this field the day before the picture was taken.

1 foot deeper than soil on areas that were not contoured. It has been estimated that this moisture increased plant growth to such an extent that approximately 500,000,000 pounds of additional protective residue was provided for the prevention of wind erosion on the 2,000,000 acres.

A wider use of thoroughly tested water-saving practices on the Great Plains will help to insure more successful crops and to control erosion. These water-saving practices include contour tillage, strip cropping, terracing, contour pasture furrowing, and other methods of using the rainfall where it will be of most benefit to growing plants.

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